

WHAT IS CLAIMED IS:

1. A liquid-jet head including a passage-forming substrate on which pressure generating chambers communicating with nozzle orifices ejecting liquid are formed; and piezoelectric elements which are provided on one side of the passage-forming substrate through a vibration plate and cause pressure changes in the pressure generating chambers,

wherein a covering plate having a piezoelectric element holding portion which covers the piezoelectric elements is joined with a surface of the passage-forming substrate where the piezoelectric elements are provided, and a nozzle plate provided with the nozzle orifices is joined with a surface of the passage-forming substrate opposite to the surface where the covering plate is joined, and at least a region of the passage-forming substrate facing the piezoelectric element holding portion is relatively thicker than an outside of the region facing the piezoelectric element holding portion.

2. The liquid-jet head according to claim 1, wherein the region of the passage-forming substrate facing the piezoelectric element holding portion is relatively thicker than the outside of the region facing the piezoelectric element holding portion at least in an aligned direction of the pressure generating chambers.

3. The liquid-jet head according to claim 1, wherein the region of the passage-forming substrate facing the piezoelectric element holding portion is relatively thicker than the outside of the region facing the piezoelectric element holding portion at least in a longitudinal direction of the pressure generating chambers.

4. The liquid-jet head according to claim 1, wherein the passage-forming substrate is tapered in thickness from the region facing the piezoelectric element holding portion to an edge of the passage-forming substrate.

5. The liquid-jet head according to claim 1, wherein a difference between a maximum thickness and a minimum thickness of the passage-forming substrate is 30 nm to 5 μm .

6. A liquid-jet apparatus comprising any one of the liquid-jet heads according to claims 1 to 5.

7. A method of manufacturing a liquid-jet head including a passage-forming substrate on which pressure generating chambers communicating with nozzle orifices ejecting liquid are formed; piezoelectric elements which are provided on one side of the passage-forming substrate through a vibration plate and cause pressure changes in the pressure generating chambers; a covering plate which has a piezoelectric element holding portion covering the piezoelectric elements and is joined with the side of the passage-forming substrate where the piezoelectric elements are provided; and a nozzle plate which is provided with the nozzle orifices and joined with a surface of the passage-forming substrate opposite the side where the covering plate is joined, the method comprising the steps of :

joining the covering plate with the passage-forming substrate on which the piezoelectric elements are formed;

grinding or polishing a joint surface of the passage-forming substrate with the nozzle plate with a predetermined load to make the passage-forming substrate have a predetermined thickness, and at the same time, forming the joint surface of the passage-forming substrate with the nozzle plate to be curved to make at least a region of the passage-forming substrate facing the piezoelectric element holding portion relatively thicker than an outside of the region facing the piezoelectric element holding portion;

forming the pressure generating chambers on the passage-forming

substrate; and

joining the nozzle plate with the passage-forming substrate.

8. The method of manufacturing the liquid-jet head according to claim 7, wherein, in the step of joining the nozzle plate, a nozzle communicating plate on which nozzle communicating holes communicating with the pressure generating chambers and the nozzle orifices are formed is joined with the surface of the passage-forming substrate, and the nozzle plate is joined with the nozzle communicating plate.